

May 29, 1956

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2,748,321

ELECTRICAL ASSEMBLIES

Filed July 31, 1952

3 Sheets-Sheet 1

FIG. 1.

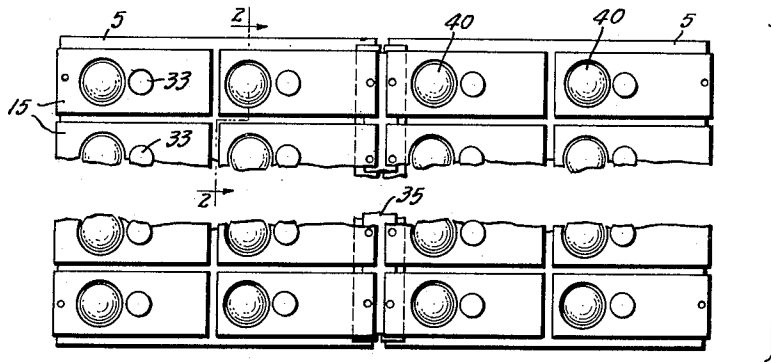


FIG. 8.

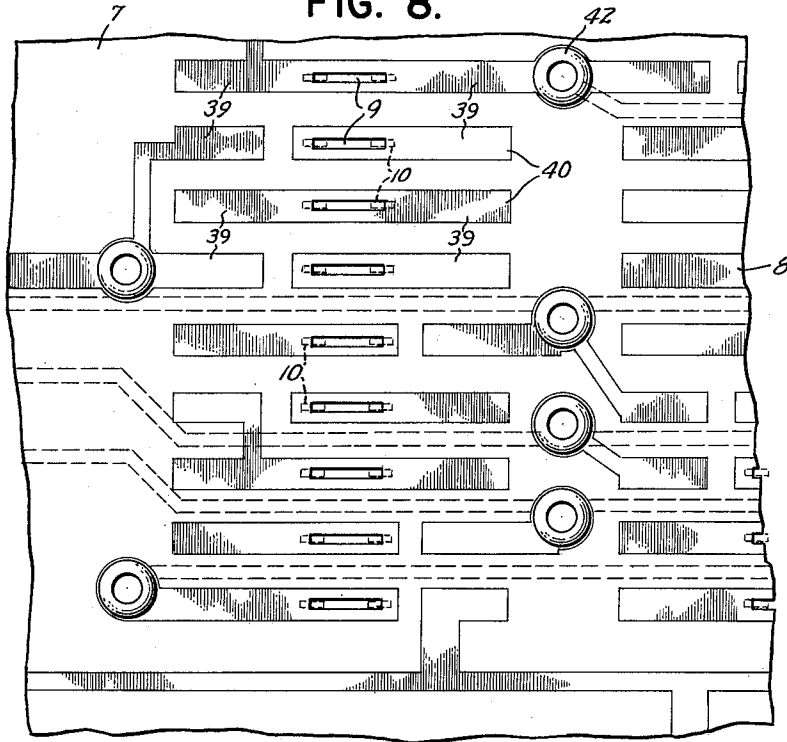
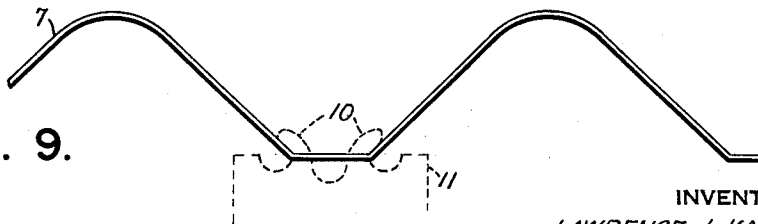


FIG. 9.



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FIG. 2.

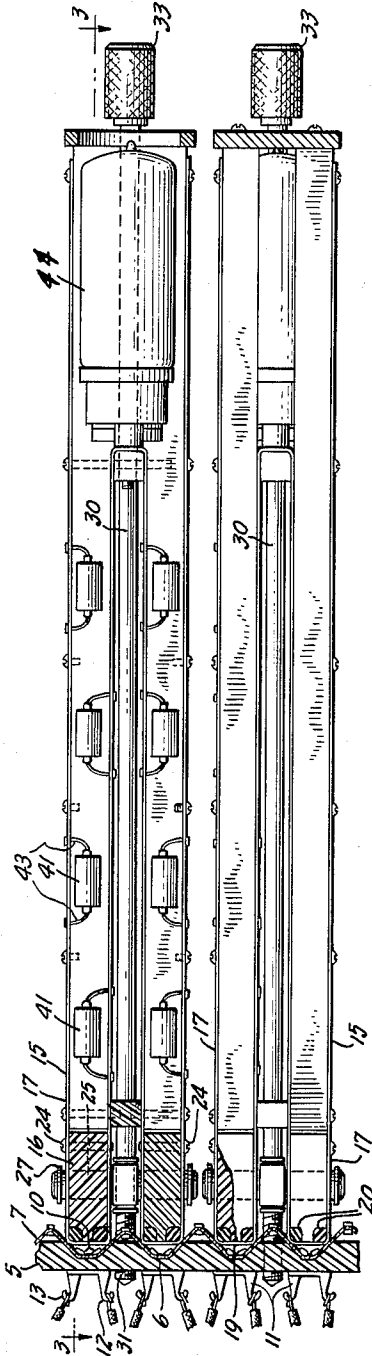
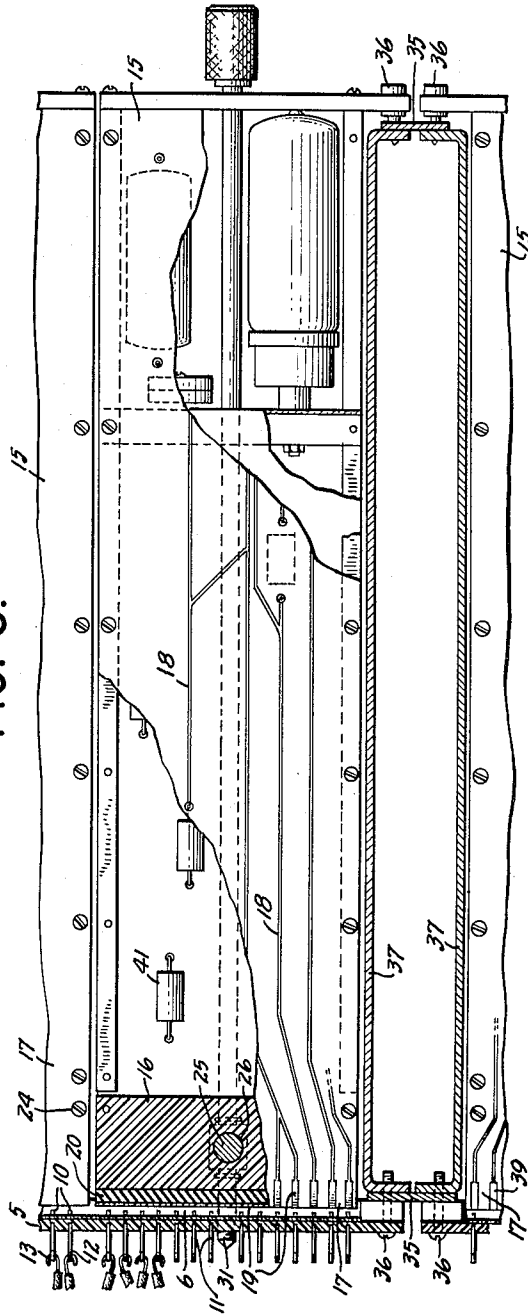


FIG. 3.



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FIG. 4.

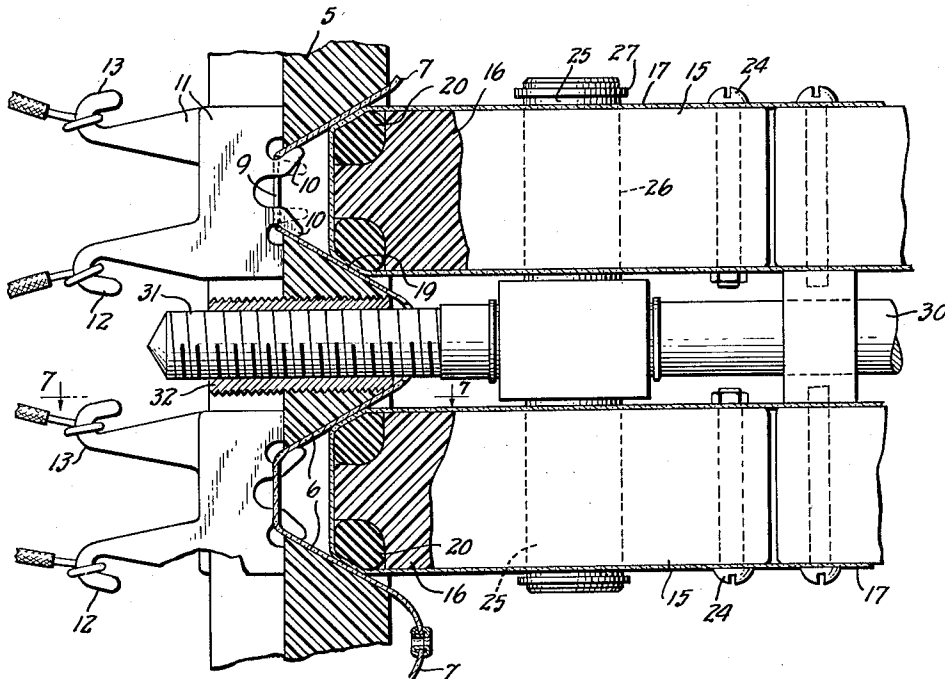


FIG. 6.

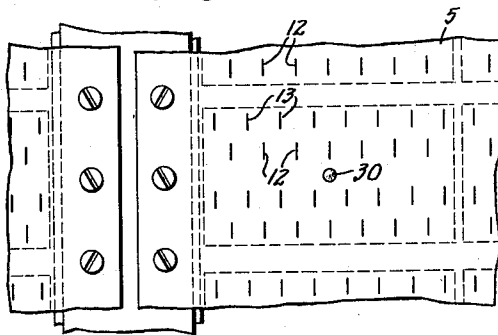


FIG. 7.

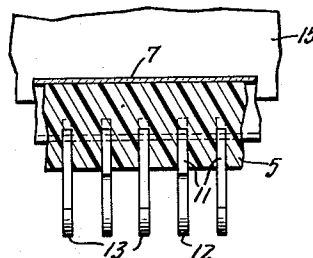


FIG. 5.

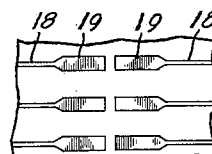
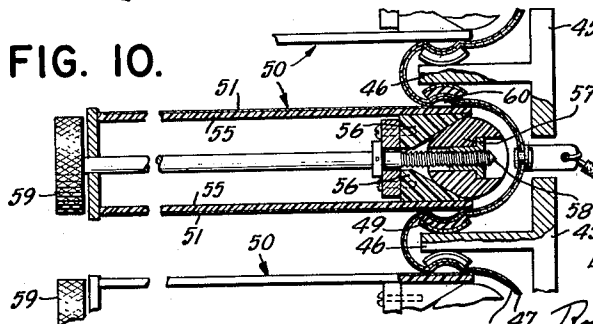


FIG. 10.



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ELECTRICAL ASSEMBLIES

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Application July 31, 1952, Serial No. 302,010

18 Claims. (Cl. 317—101)

This invention relates to electrical assemblies, and more particularly to electrical circuit assemblies, and to correlated inventions and discoveries appertaining thereto.

So-called "printed circuits" and other arrangements where electrically conductive patterns are mounted on insulating means have been in wide usage for a number of years, but their use has been restricted by the laborious procedures involved in connecting them with other printed circuits. Electrical connector assemblies have also been used for many years; but ordinarily, in such an arrangement, the whole assembly has to be taken out of effective use while repairs—which are sometimes long-drawn out—are made, and often even while the source of the trouble is being located. Difficulties have also been experienced in connecting electrical assemblies to other parts of an electrical system in assuring that contacting parts will be kept clean and conductive, in positively and effectively assuring the association of contacting parts, and in solving others of the electrical and mechanical problems involved.

With the foregoing and other considerations in view, the present invention contemplates the provision of arrangements whereby electrically conductive patterns are easily and effectively brought into contacting relationship; of arrangements wherein electrical-pattern "packages" are removably mounted for easy and immediate replacement when trouble occurs, after which the source of the trouble can be located by testing the removed package at leisure; and of efficiently arranged and effectively-mounted contact assemblies and assembly-parts.

The invention accordingly comprises an article of manufacture possessing the features, properties, and the relation of elements which will be exemplified in the articles hereinafter described and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a front view of an electrical connector assembly embodying the invention with the central part broken away;

Fig. 2 is an enlarged fragmentary sectional view along the line 2—2 of Fig. 1;

Fig. 3 is a partly sectional view along the line 3—3 of Fig. 2;

Fig. 4 is a further enlargement of the left-hand upper portion of Fig. 2;

Fig. 5 is a flattened-out view of the printed circuit on the male member looking from the left;

Fig. 6 is a schematic showing of the arrangement of the terminal portion shown at the left of Fig. 4;

Fig. 7 is a fragmentary sectional view along the line 7—7 of Fig. 4;

Fig. 8 is a greatly enlarged laid-out view of a portion of a printed circuit arrangement of a female member.

Fig. 9 is a section therethru expanded longitudinally to

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correspond with the straightening of the sheet in Fig. 8; and

Fig. 10 is a view similar to Fig. 2 showing a modified form of construction.

In the form of construction exemplified in Figs. 1—8 there is illustrated a female member 5 formed of insulating material, such as phenolic resin, and having therein a plurality of two-sided indentations 6. In each indentation, and in the present instance extending also from indentation to indentation, is a sheet 7 of insulating material such as glass cloth impregnated with phenolic resin carrying a pattern of conductive material 8 which may be in the form of a "printed circuit" and may be a sheet of copper foil laminated to the insulating sheet and selectively etched away to leave the desired pattern.

In the present instance the sheet is slit as indicated at 9 in order to receive prongs 10 of sheet-metal terminals 11. These slits are alined with holes in the female member 5. A preferred method of manufacture is to cement an unslit sheet to the female member and then cut vertical slots on the reverse side of the female member of such depth that they break thru the bottom of the indentations 6. These slots also serve to aline the terminals; and their bottoms are the surfaces against which shoulders of the terminals abut. Alternate ones of the terminals 11 have thereon hooks 12 in a lower row and alternate ones thereof have thereon hooks 13 in an upper row. The hooks 12 and 13 are adapted to have wires wrapped around them or hooked over them, as for soldering. The prongs are passed thru the slits while in the position shown in dotted lines in Fig. 4, and are then bent to the position shown in full lines in order to hold the terminals securely in place. In bent position, a prong will ordinarily contact a portion of the conductive pattern. Such portion will in many instances be unconnected electrically with portions contacted by other prongs so that it will require the action of a supplemental mating contact, as a portion of the conductive pattern on a male unit, to complete a circuit therethru.

Adapted for insertion in each depression 6 is a male unit 15 having a body 16 of hard insulating material, such as phenolic resin, which has wrapped thereover a sheet 17 of insulating material such as glass cloth impregnated with phenolic resin carrying thereon a conductive pattern 18 the corner portions 19 of which are adapted to contact with portions of the conductive pattern 8 in a predetermined manner. On one side of the sheets supporting each pair of contacting surfaces, and, in the present instance, on the male unit 15, is a mass of yieldable material 20, such as rubber. This not only assures a pressure contact between the members, but, in conjunction with the inclined position of the female contacts, assures a wiping contact as the male unit comes into contact with the female member.

Screws 24 serve to hold the sheet 17 firmly in place on the resinous body 16.

At various points along the conductive pattern 18, two portions of such pattern are connected by electrical components such for instance as rectifier elements. These components tend to fail on occasion and when one does it is a tedious and time-consuming operation to determine which one has failed and to replace it. Since it is undesirable that the entire installation be kept out of commission while a repair and replacement operation is going on, it is desirable that the difficulty be placed in a fairly extensive electrical sub-assembly and that this thereupon be removed and replaced after which the trouble therein can be located and repaired at leisure. It is to be observed that the extent of the male unit 15 is double.

Pursuant to the invention, there is provided a "package" which can be removed and replaced so as to greatly reduce the testing time necessary before the removal of a

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portion from the installation. Further pursuant to the invention, the extent of the package may be further increased by coupling a plurality of male units together. In the present instance, two units 15 are coupled by means of a crossbar 25 extending thru holes 26 in the units and formed with retaining rings 27 on the outside surfaces thereof. In order to easily and effectively move the package into place and drive the male units forward so as to bring the surfaces 19 into wiping and contacting engagement with their mating surfaces, a rod 30 extends thru the crossbar 25. In the present instance a screw portion 31 is threaded into a bore 32 in the female member. Adjustment or removal of a package is effectuated by turning a knob 33. Any desired number of male packages of any desired extent may, of course, be employed. In order to expand the assembly a plurality of female members 5 may be joined as by means of connecting plates 35, screws 36, and brackets 37 as shown in Fig. 3.

The printed circuit portions 18 on the upper side of a male member terminate in contact portions 19 and similar circuit portions 18 on the lower side of the male members likewise terminate in portions 19. Contact portions 19 are physically and electrically separated from each other as shown in Fig. 5.

As exemplified more particularly in Fig. 8, the printed circuits comprise various normally-unconnected conductive strips. In Fig. 8 a number of the conductive strips 40 having contacting portions 39 are shown on the sheets 7. When the male and female members are assembled, the various contact portions serve to interconnect certain of the conductive strips. Circuit portions on the sheets 17 are connected in certain instances by electrical components such as resistors or diodes 41 (Figs. 2 and 3) which are mounted by wiring 43. Various circuit portions lead to vacuum tubes 44 and to other electronic equipment. Connectors 42 (Fig. 8) are provided on the female member.

In the form of construction exemplified in Fig. 10, there are provided brackets 45 having forwardly extending ribs 46 about which there is wound a sheet 47 of insulating material carrying an electrical pattern arrangement in the form of a printed circuit 48. On each side of each rib 46 the sheet 47 is mounted on a resilient curved trough-like element 49 comprising a pad of yieldable material such as rubber backed by a curved member of spring material. The purpose of this shape is to produce wipe when the trough is compressed flat. Between each pair of ribs 46 is an expandable unit 50 carrying a printed circuit 51 adapted to contact with the printed circuit 48. The member 50 is composed of two sheet insulators 55 each carrying a triangular block 56 between which is a wedge-shaped member 57 adapted to be drawn between the blocks by a screw 58 operated by a handle 59. As the screw is drawn to the left (Fig. 10), the sheets 55 of a pair are forced apart exerting a compressive action between the yieldable means 49 so that there will be a wiping contact at 60.

Since certain changes may be made in the above article and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

Certain subject matter disclosed but not claimed herein is claimed in certain of my copending applications, Serial No. 252,333, filed October 20, 1951, and Serial No. 296,178, filed June 28, 1952, and/or in one or more of the divisions of the latter, Serial No. 557,086, filed January 3, 1956, and Serial No. 557,087, filed January 3, 1956.

I claim:

1. An electrical assembly comprising a pair of insulating members each carrying an electrically conductive coating pattern having a set of exposed contact portions which mate with each other, compressible resilient insulating means providing a backing means to yieldably back at least one of each pair of mating contact portions on at least one of said members, one of said pair of in-

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5 insulating members being arranged for bringing said contact portions into electrical contact by sliding contact during which the yieldably-backed contact portions yield to permit said contact portions to be brought into positive engagement, and for rearward movement to break said engagement.

2. A contact member comprising a plug end, a sheet of flexible insulating material extending about said plug end, and an electrical conductive coating pattern extending over at least portions of the sheet in the part thereof which extends over said plug end and presenting different contact arrangements at different points thereon, said plug end providing compressible resilient backing means at said portions.

3. An electrical assembly comprising a plug end, a sheet of flexible insulating material extending about said plug end, an electrical conductive coating pattern extending over at least portions of the sheet in the part thereof which extends over said plug end, a socket member for receiving said plug end and having rigid converging sides, a contact element on each of said sides for respectively contacting portions of said conductive pattern, and yieldable means for mounting the last-mentioned portions.

4. An electrical assembly as set forth in claim 3 wherein said contact elements are part of an electrically conductive pattern.

5. An electrical connective assembly comprising a pair of opposed connective members movable between mating and separated positions, one of said opposed members comprising a plurality of separate connective sub-assemblies containing electrical connections, each having a plurality of contact portions integral with said connections, means to interconnect certain of the contact portions in each sub-assembly, and the other of said opposed members comprising conductive portions having contact portions adapted to contact various of the contact portions of various of the subassemblies, means to bring the contact portions on said other of said opposed members into effective electric contact with the contact portions of said subassemblies, and means to yieldably back at least one of each pair of contact portions which contact each other, and a sheet of flexible insulating material forming part of one of said opposed members and having adherent to a surface thereof a conductive pattern including certain of said contact portions.

6. An electrical assembly comprising a panel, sockets in said panel, a pair of plugs aligned with a pair of said sockets and adapted to engage a pair of said sockets, aligned openings extending transversely through said plugs, a bar extending snugly but freely thru said openings, and a rod extending parallel to and between said plugs thru said bar and into said panel and in tractive engagement with said bar and said panel for bringing said plugs and said panel together.

7. An electrical assembly as set forth in claim 6, wherein the rod is threaded into said panel for moving said plugs into their sockets.

8. An electrical connector assembly comprising a pair of supports at least one of which is movable, insulating means on one support having adherent to a surface thereof a multiplicity of separated and interrupted layers of conducting material a plurality of which are present at each of a plurality of linear positions, and insulating means on the other support having adherent to a surface thereof a multiplicity of separated and interrupted layers of conducting material a plurality of which are present at each of a plurality of linear positions adapted to be aligned with the aforesaid linear positions when said insulating means are juxtaposed to cause the mating of various pairs of said layers.

9. An electrical connector assembly as in claim 8 wherein a plurality of the layers of each of said insulating means are branched to interconnect in parallel a plurality of electrical devices with another electrical device.

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10. An electrical connector assembly comprising female mounting means providing a series of linearly-extended sockets, an insulating sheet extending into and between said sockets, a multiplicity of conductive strips adherent to said sheet, a plurality of said strips extending into only a single socket and a plurality of other of said strips extending into at least two sockets and therebetween, male mounting means providing a series of linearly-extended plugs opposing said sockets, at least one of said mounting means being movable to bring said plugs into said socket, an insulating sheet extending about and between said plugs, and a multiplicity of conductive strips adherent to the last-mentioned sheet and adapted to mate with various of the first-mentioned strips at various positions, a plurality of the last-mentioned strips extending onto only a single plug and a plurality of said last-mentioned strips extending onto at least two plugs and therebetween.

11. An electrical connector assembly as set forth in claim 10 wherein various pluralities of the strips on at least one of said sheets are interconnected.

12. An electrical connector assembly as set forth in claim 11, wherein a multiplicity of electrical instruments are variously connected to various ones of the strips on said one of said sheets.

13. An electrical connector assembly comprising female mounting means providing a series of linearly-extended sockets, an insulating sheet extending into and between said sockets, a multiplicity of conductive strips adherent to sheet, a plurality of said strips extending to only one side of one socket, a plurality of said strips extending from one side of one socket to one side of another socket, a plurality of said strips extending to both sides only of one socket, and a plurality of said strips extending to both sides of one socket and to at least one side of at least one other socket, male mounting means providing a series of linearly-extended plugs opposing said sockets, at least one of said mounting means being movable to bring said plugs into said sockets, an insulating sheet extending about and between said plugs, and a multiplicity of conductive strips adherent to the last-mentioned sheet and adapted to mate with various of the first-mentioned strips at various positions.

14. An electrical connector assembly as set forth in claim 10 wherein compressible resilient backing is provided for a contacting portion of at least one layer at each point wherein a layer on one of said insulating means mates with a layer on the other of said insulating means to provide wiping contact when mating and tight contact when mated.

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15. An electrical assembly as set forth in claim 1 wherein said compressible means and the contact portions backed thereby are carried on said one of said members.

16. An electrical assembly as set forth in claim 1 wherein said contact portions backed by said compressible means are arranged diagonally to the direction of said forward and rearward movements.

17. An electrical assembly as set forth in claim 1 wherein flexible insulating material is provided between the compressible means and the contact portions backed thereby.

18. An electrical assembly comprising a panel having a surface of insulating material carrying circuitry in the form of conductive coatings on portions thereof, a plurality of conductors connected to the circuitry on said panel, a plurality of electrical component subassemblies, various of said subassemblies having an end facing said panel and a side extending away from said panel, a surface of insulating material on said end and on said side and carrying circuitry in the form of conductive coatings on the last-mentioned surface, a plurality of electrical components on said side electrically engaging various of the circuitry, said subassemblies being adapted to be moved to bring their ends into and out of engagement with said panel, the circuitry on said ends of said subassemblies and the circuitry on said panel having portions which overlap when the ends are so engaged with said panel, whereby the circuitry on said subassemblies is in electrical contact with the circuitry on said panel to variously interconnect said components and said conductors.

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